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FACE-TO-FACE VS. CMC: STUDENT COMMUNICATION IN A TECHNOLOGICALLY RICH LEARNING ENVIRONMENT

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ABSTRACT

Observations of student behaviour in the first year of a new degree program showed several unexpected behaviours with regard to the use of several computer-mediated communication methods. A detailed survey of communication behaviour within the degree was undertaken, assessing how much, and for what purposes, students used the available methods of communication, and what they perceived to be the strengths and weaknesses of each method of communication. The results show that face-to-face communication is preferred over all forms of computer-mediated communication. The findings of the study highlight the pedagogical advantages of being flexible in terms of the communication methods students can use. Specifically, while some of the devices provided by staff were not used by students, others not formally introduced into the degree were embraced by the majority of students.

KEYWORDS

communication, computer-mediated communication, CMC, student communication, information environments

Introduction

The Bachelor of Information Environments (BInfEnv) degree is a new degree program at The University of Queensland which enrolled its first intake of students at the beginning of 1999. The BInfEnv is a new breed of Information Technology (IT) degree that concentrates on the design of the interaction between people and information, specifically how people interact with computers and other computational devices. Information environments can be thought of as systems that allow people to access and share information and coordinate their activities be they work or play related. Although the BInfEnv includes core Bachelor of Information Technology subjects, the emphasis is very much on *design and communication* rather than computation. Studio-based projects, group work and reflection are all important components of the BInfEnv.

Students are provided with a wide range of communication mediums by which they can communicate with staff and other students. Not only does this support their learning activities (particularly the group work), it is an essential part of the degree. Students should graduate from the program with exposure to and experience with a wide range of communication methods. During the first year of the degree (1999) a number of informal observations were made of student communication behaviour. Three elements of this behaviour stood out as being unexpected:

1. A number of subjects had associated WebCT sites that contained content and offered access to web-based chat and bulletin-board (forum) utilities. It was observed that students accessed the site for content but did not use the built-in communication utilities.
2. Student lab computers were provided with a standard software installation that contained a number of computer-mediated communication tools. Internet Relay Chat (IRC) was not one of these, however many students downloaded and installed an IRC client and made significant use of this medium to communicate with other students. The students established a degree specific channel (#binfenv) on the University's IRC server.
3. Academic staff in the program split their time between two campuses and were therefore not physically available to students for more than a couple of days per week. Despite this, and encouragement to contact staff electronically, students would often wait until staff were physically available in order to raise issues or ask questions relating to the course material.

Based on these observations and a desire to better understand student communication behaviour, it was decided to examine this behaviour more closely. A survey was undertaken to examine how various communication methods (particularly computer-mediated communication methods) are used to support learning in the Information Environments program and specifically, how they are used to support student-student and student-staff communication.

The remainder of this paper is organized as follows. Section 0 contains background information including related work, a description of the Bachelor of Information Environments degree and a description of the various communication methods available to students. Section 0 describes the study undertaken of the BInfEnv students. The results of the study are presented and discussed in section 4. Conclusions are drawn in section 0.

Background Information

RELATED RESEARCH

Tolmie and Boyle (2000) described eight factors associated with successful computer-mediated communication in higher education. These include:

- *student experience*: it is better if students are experienced communicators;
- *ownership of task*: it is better if the students are involved in the definition of the task;
- and
- *need for system*: if the functions offered by the CMC cannot be easily served by other means.

A number of studies have looked at how students use specific computer-mediated communication (CMC) tools or types of tools. Benson and Hewitt (1998) trialled a

computer-mediated communication (CMC) tool with students from the Bachelor of Social Work degree in Monash University. A computer conferencing system called WebFace was introduced to facilitate student communication. Despite initial connection problems, the collaborative experience was found to be beneficial by the students. Students recognised the opportunities to collaborate and to reduce isolation. They also gave comments related to increasing motivation and improving learning.

According to the feedback from the students of a computing subject offered by Open University as a distance learning subject, Wilson and Whitelock (1998) found that the students rated their CMC environment (FirstClass from Softarc) highly. It was more beneficial than the telephone as more considered responses were able to be given by tutors in their own time, students didn't have to scribble down tutors' responses and remote students were put in better contact with their tutor and other students.

Ingram et al. (2000) experimented with the deployment of graphical components in chat programs. They found that synchronous communication over the Internet did not generally encourage deep reflective conversations: quick thinking and fast typing were favoured over careful thought. In order to enhance and increase the education value of discussion via such CMC tools, tasks, group sizes, moderating techniques and other variables have to be carefully chosen.

A number of studies have compared CMC with face-to-face communication. The study by Ruberg et al. (1996) revealed that the CMC discourse encouraged more experimentation, sharing of early ideas, increased and more distributed participation, and collaborative thinking compared with face-to-face communication. Some students found the CMC activities confusing and inhibiting because of the lack of social cues and multiple threads of simultaneous topics, however, these were the same features that appealed to other students. It is concluded that successful use of CMC activities requires a social environment that encourages peer interaction. It is also important to select and structure the tasks to diminish confusion but still allow spontaneity and experimentation.

In the group decision experiment of Olaniran et al. (1996), it was confirmed that face-to-face (FTF) medium brought greater overall satisfaction than the CMC. Though their subjects reported FTF meetings were more effective in idea generation and evaluation than CMC meetings, CMC groups produced more ideas when brainstorming than did FTF groups. The authors went on to suggest the advantages offered by CMC to teams collaborating on a term-long project:

1. The convenience of running virtual meeting rather than hard-to-schedule FTF meetings, which further exploited the asynchronous nature and record storage/retrieval features of CMC.
2. CMC heightened vigilance in the student groups using CMC for decision-making meetings. This was possible because CMC group members had more time to reflect upon assumptions, issues which were recorded in the archive.
3. Using CMC for a term project would better prepare students for the type of work in their future employment.

However, CMC also presented some disadvantages to groups working on projects: time costs associated with more extensive and reflective group discussions and the text-based bias for communication embodied in most CMC systems. Laszlo and Castro (1995) point

out that “technology is not a substitute for collaborative, interpersonal exchanges of information and experience”

THE BACHELOR OF INFORMATION ENVIRONMENTS DEGREE

The degree is a three-year (six semester) program with an optional honours year. Each full-time semester consists of four subjects. Typically this consists of a studio subject, an information technology (I.T.) subject, a design subject and either an elective or an information environments (I.E.) subject (depending on the semester). The I.T. subjects introduce technical concepts (programming, databases, networks, operating systems etc); the design subjects cover visual thinking, multimedia, interactive media, human computer interaction and information visualisation; and the I.E. subjects cover the history, theory and practice of information environments.

The studio subjects form the core of the Bachelor of Information Environments degree. These are modelled on the architectural studio and encourage a community of learners to interact to solve problems. It is an immersive approach to learning where open problems are visited iteratively. The studio subjects offer students an opportunity to solve real design problems in ways that mirror the work of professionals in the world of information technology. The essence of a studio project is: team work, collaborative learning, reflective practice and the application of related knowledge to new contexts. Students typically face two open-ended problems during a studio. Students have to work together to come up with a conceptual design and to implement a demonstrator at the end of the semester for presentation. Working in studios, the students develop their design and team skills and apply knowledge and techniques learned in other subjects. The group work provides for collaborative learning where students choose to learn and to focus. Communication is a very important part of this learning process, and the program provides students with a wide range of communication methods.

COMMUNICATION METHODS

The following sections describe in detail the communication mediums to which the students have access. Details are provided where particular mediums have been formally introduced or provided to the students. Computer-mediated communication methods are considered first, followed by other methods.

Computer-mediated Communication Methods

Electronic Mail (Email)

All Information Environments students are provided with an email address. Email tools are provided and students are expected to read email often. Majordomo mailing lists (Great Circle Associates 2000) are created for all subjects. All staff and students associated with a subject are members of the subject email list and may send messages to the list. The email lists are used for announcements by staff, and discussion and questions relating to the subject.

Internet Relay Chat (IRC)

IRC (IRC.org 2000) is a system for online text-based chatting. Users use a client program to connect to an IRC server. Users are identified by unique nicknames and join “channels” to take part in (or just observe) conversations on those channels. IRC was not formally introduced within the program in 1999, but based on the experience with the

first cohort, an IRC client was provided by default in 2000 and incoming students were provided with training during an orientation week training session.

Multi User Domain, Object Oriented (MOO)

Originally developed for interactive role-playing games, a Multi-user domain, Object-Oriented (MOO) (MUD.org 2000) is a virtual place for people to socialise and communicate, collaborate and work. A MOO is a text-based virtual reality environment that uses a spatial metaphor, ie, users of the environment (called players) can 'move' through a 3-dimensional (textual) space interacting with each other and with objects they (create and) discover. The MOO provides mechanisms for users to communicate with specific users who are connected to the MOO; all users in a room; and all users in the MOO. The MOO also provides inbuilt email and news (bulletin-board). All BInfEnv students are provided with a MOO login and instruction on using and programming the MOO and are required to use the MOO for several programming exercises.

World Wide Web (WWW)

The WWW is used by several staff within the program for delivery of subject content, anonymous feedback and provision of student assignment results (via a password protected interface). Students develop personal web sites during the first semester of the course and also submit their Studio portfolios as a web-site.

Web Course Tools (WebCT)

WebCT (Goldberg 1996, WebCT.com 2000) is a set of integrated course tools that support the design and delivery of web-based material. For students, these tools can include chat, bulletin-board, mail, calendar, and online quizzes. Several subjects offered in 1999 had associated WebCT sites which students were able to access for supporting material. Students were required to access the WebCT site for some services (e.g. to access their mid-semester exam marks). The library provided introductory training courses to students on how to use WebCT.

Tickertape

Tickertape (Parsowith 1998, DSTC 2000) is a one-line window which displays scrolling messages. Only messages which match a user's selection criteria (or *subscription*) are displayed. The Tickertape application also allows users to send messages. Figure 1 shows an example of a Tickertape window – this is typically placed at the top or bottom of a screen. Decoration around the scrolling message (i.e. the window frame) can be removed if desired. A common usage of Tickertape is as a chat-service. Users subscribed to the "Chat" channel see all Chat messages and may post their own messages.



Figure 1. The Tickertape window.

The Tickertape application was made available to BInfEnv students in 1999 but limited instruction was provided. In 2000, Tickertape is provided and now automatically starts when a student logs in and students have been provided brief instructions on how to use and configure the application. The application may be easily quit if students so desire.

Instant Messengers

Instant messaging software allows users to communicate with each in real-time. ICQ (ICQ.com 2000) is a typical example of this type of software. ICQ is not currently available to BInfEnv students via university computers. Many students use it via a private Internet Service Provider.

Non-computer-mediated communication methods

Face-to-face communication is used for most content delivery within the degree. Academic staff are available on the Ipswich campus two to three days per week (on average). On other days, staff are at the St. Lucia campus or working at home (often online).

Paper (or, more generally, *written communication*) is used for a large fraction of teaching/learning communication. Most subject handouts are produced on paper (as well as often being available electronically) and most student assessment takes place via paper.

Fixed and mobile phones are a common communication method. Students have ready access to campus internal phones within computing laboratories, library etc. Second year students have smaller studio spaces with dedicated desks and computers and easier access to university internal phones. It has been observed that a large proportion of BInfEnv students have mobile telephones.

The Study

COMMUNICATION IN THE BINFENV DEGREE

For a variety of reasons, the ability to communicate well is an important skill for students in the Bachelor of Information Environments degree to acquire. The degree focuses on and encourages learner interaction and small group work for which the ability to communicate with peers (who are sometimes only able to be present virtually) is essential. Moreover, a broad goal of the degree is to provide students with a skill set that will allow them to acquire industry positions and excel in them. Obviously, the ability to convey one's ideas and collaborate both in person, and via electronic means, is essential in industry today. Finally, given that staff in the Bachelor of Information Environments degree work across two campuses, in order to foster the richest and most stimulating learning environment possible, it is important that students make use of all available means of communication with staff and that staff maximise their availability to students.

Students are also provided with the flexibility to install their own or downloaded (freeware) software on lab PCs. This freedom allows students to explore computer-mediated communication methods unforeseen by the program staff. A brand new degree program also offers a unique opportunity for studying student communication. There are no tried-and-true "traditional" methods and the first intake of students have no peers to emulate or learn from – they were (and are) free to develop a new communication culture.

Recognising the importance of fostering effective communication channels between and among students and staff, the aim of this study was to gain insight into which means of communication students use, why they use and don't use particular mediums, and for what purposes different forms of communication are used. Ultimately, such insight can

be used to benefit students in the degree by adjusting staff's use of different means of communication, making appropriate alternative means of communication available, and educating student's to any unrealised benefits of available devices.

RESEARCH QUESTIONS

Based on these aims, findings from previous research, and observed student communication behaviour, several research questions were generated. Two research questions, specific to second year students (the first cohort), that arose on the basis of observed behaviour, were 'Why did second year students chose not to make use of the communication facilities provided as part of the Web CT interface' (RQ1), and 'Why did second year students so readily embrace IRC as a means of communication within the degree?' (RQ2). More general research questions that arose as a function of the aims of the paper and the existing literature were 'What are students' preferred means of communication?' (RQ3), 'What are the perceived strengths of preferred means of communication, and the weaknesses of non-preferred means of communication?' (RQ4), and 'What purposes (learning-related and otherwise) are specific devices used for?' (RQ5). In the process of answering these questions, it was expected that it would be possible to address the final research question, based on observed behaviour, 'Why do students often choose to use face to face communication in preference to computer-mediated forms of communication?' (RQ6).

STUDY METHOD

Design

The study employed questionnaire measures to assess the use of different forms of communication used by students within the BInfEnv degree. Measures were taken of levels of use of forms of communication to contact both students and staff, on and off campus, the purposes for which different forms of communication were used, and the perceived strengths and weakness of the different forms of communication.

Participants

Fifty-six Information Environments students (86% of the population) participated in the study, 47 (83.9%) were male and 9 (16.1%) were female, 43 (76.8%) were first year students and 13 (23.2%) were second year students. Participants ranged in age from 17 to 34 years and the mean age of participants was 20.46 years.

Measures

The questionnaire assessed the use of 11 different forms of communication; mobile phones, telephones, IRC, MOO, email, WWW, WebCT, Tickertape, face to face, instant messengers, and hand written communication. For each form of communication students were asked to complete four items indicating how often they used each form of communication for contacting staff and students on and off campus (1 never to 8 always). Students were then asked to select from a list of purposes (i.e., to discuss general information environments work, to discuss assessment items, to discuss work for which you are paid, to discuss specific social activities, to chat or interact socially, other) those for which they used each device, and the purpose for which they most often used the device. Finally students were asked to list what they saw as the strengths and weaknesses of each device.

Procedure

Questionnaires were completed by students in class. Students were told that the questionnaire was being conducted in the interests of assessing how students in the Bachelor of Information Environments communicate. Students were asked whether they wished to participate and assured that their responses were completely anonymous. Students were also informed that if they chose to participate they had the right to skip any question they did not wish to answer. When students had completed the questionnaire they were thanked for their time and given contact details to use should they wish to obtain further information about the study.

Coding of Qualitative Responses

For the purposes of qualitative analysis, students' responses to the items assessing the strengths and weaknesses of means of communication were coded into categories. Two raters independently assessed a sample of questionnaires and discussed the categories they initially formed. These categories were refined by the raters through further discussion during the coding process, resulting in 12 categories for strengths (can delay/consider response, convenient, easy to use, fun/satisfying, inexpensive, instantaneous/real time, large network of users, logged, supports multiple communication channels, users can be geographically distributed, allows simultaneous communication with many, and other) and 11 categories for weaknesses (slow, difficult to use, limited channels of communication, expensive, requires availability of specific device/application, requires parties to be in a specific location, not logged, intrusive, susceptible to spam, potential for delayed response, and other). Both raters categorised all responses and Cohen's Kappa coefficient was calculated to assess the inter-rater reliability. For strengths kappa's ranged from .89 to .94 across devices, and for weaknesses from .81 to .96. All inter-rater categorisation discrepancies were resolved through discussion.

RESULTS and DISCUSSION

Due to the limited number of responses from second year students, it was decided to examine the question regarding the use of WebCT communication utilities (RQ1) qualitatively. Some relevant comments about WebCT that give some insight into why the communication tools weren't used by the students, include:

- "subject web-pages just as effective [in delivering content]"
- "could use email instead"
- "[communication is] sort of like email but much much slower"
- "bad interface" (there were many variations along this theme)

In an environment where multiple other communication methods are available and WebCT usage is not mandated (for communication) students preferred to use other methods. As Tolmie and Boyle (2000) noted, a CMC method is only successful if there is a need for the system, i.e., if the functions can not be easily served by other means. Clearly in this case students found other communication mechanisms (such as subject web sites and email) more appropriate. Another issue is the quality of the interface – students found the web-based interface inappropriate for chat, email and bulletin-board functions.

While the students' decision not to use WebCT as a communication tool is not, in itself, problematic, it potentially removes a forum in which subject or assessment specific discussions could take place. Losing the opportunity to encourage and conduct such

discussions raises pedagogical concerns, however, it seems unlikely that much will be gained from trying to coerce the students into using WebCT as a communication tool. A possible solution would be to create space for such discussions in the MOO or IRC. Both mediums allow for subject specific rooms or channels, and hence it would be possible to dynamically create discussion spaces devoted to particular course work issues. (This idea is strengthened by the fact that other results show the MOO and IRC are popular communication tools amongst the students, see below.)

In assessing why the first cohort of students adopted IRC so readily (RQ2), a qualitative approach was again taken. Some of the comments made about the strengths of IRC provide insight:

- “easy, simple, allows collaboration”
- “easy to communicate”
- “can communicate at a distance”
- “don’t have to give [it] your undivided attention”
- “enables both one to one and group communication”

Giving students the freedom to experiment with other communication mediums allowed them to discover and use a form of communication that appealed to them. It is likely that the students developed what Tolmie and Boyle (2000) would refer to as ‘ownership of task’. Part of the reason that students use IRC may be that they see it as ‘their own thing’ in some sense. Earlier, the possibility of using IRC for subject specific discussions was raised. Such initiatives, on the part of staff, should be undertaken with caution, as it would benefit neither students, nor staff, to chase the students away from IRC in the process of trying to create a richer learning environment¹.

To assess students’ preferred means of communication (RQ3), mean levels of use were compared, across devices, for contacting staff and students, on and off campus (Table 1). Overall, students showed a preference for face to face communication above all forms of computer (or device) mediated communication. This is congruent with previous research showing that more personal forms of communication are often favoured over computer-mediated communication (Ruberg, et al., 1996; Olaniran et al., 1996). The preferred forms of device mediated communication were email, the MOO, and the telephone.

A comparison of the mean levels of use for ‘students overall’ and ‘staff overall’ reveals that while students use a variety of devices for communicating with each other (email, the MOO, telephones, IRC, mobile phones and Tickertape) they focus largely on face to face communication and email for contacting staff. The staff in the degree tend not to frequent the MOO or IRC channels and only some staff regularly run Tickertape. The fact that students have shown a willingness to use these devices re-raises the possibility (mentioned above) that they could be explored as alternative means of staff-student communication. For example, a staff member’s appearance in the MOO or the ‘#binfenv’ IRC channel would give students an opportunity to ask questions, and could lead to the spontaneous generation of informal tutorial-style discussions.

¹ It seems likely that the two uses of IRC could co-exist. Because IRC is based on a system of channels or rooms (and at a higher level – a system of servers), it should be possible for staff to create, and frequent, work related channels without entering other areas that students might consider their own domain.

Interestingly, Tickertape was the third most used method of contacting on campus staff but the least used method of contacting off campus staff. It may be that students' are unaware that Tickertape can be run from off campus locations. Ensuring that staff run Tickertape when off campus and making students aware that they can reach off campus staff via Tickertape, could furnish students with an alternative means of contacting staff. In this way, some of the problems associated with staff working across two campuses could be alleviated. One of the advantages of Tickertape in this regard, is that students do not need to know where staff are physically located in order to reach them. Tickertape could be used, in the first instance, to send such a message such as 'are you there lecturer Y?', and from this point an appropriate medium of communication could be selected by the staff member and student to continue the conversation (indeed research has shown Tickertape to be an invaluable tool for location of peers (Fitzpatrick et al. 1999)).

Table 1. Students' mean levels of use of differing forms of communication for contacting students and staff on and off campus, in descending order^a.

Students on Campus	Students off Campus	Students Overall	Staff on Campus	Staff off Campus	Staff Overall	Overall Use
FTF (7.54) Email (4.64) MOO (3.84)	Email (5.09) FTF (4.80) Tele (4.13)	FTF (6.17) Email (4.87) MOO (3.30)	FTF (5.61) Email (4.39) TT (2.17)	Email (4.18) FTF (2.03) WWW (1.84) Tele (1.80)	Email (4.29) FTF (3.82) WWW (1.87) Tele (1.78)	FTF (5) Email (4.58) MOO (2.45)
TT (2.90)	MOO (2.76)	Tele (2.95)	WWW (1.89)	IRC (1.46) Writ (1.42) MOO (1.41)	TT (1.66) MOO (1.59) Writ (1.56)	Tele (2.36)
IRC (2.39) Writ (2.11) Mob (1.85)	Mob (2.58) IRC (2.45) INM (2.39)	IRC (2.36) Mob (2.18) TT (2.03)	MOO (1.77) Tele (1.73) Writ (1.70)	WCT (1.29)	IRC (1.13)	IRC (1.93) TT (1.85) WWW (1.80) Mob (1.78)
Tele (1.76)	WWW (1.77) Writ (1.57)	INM (1.87) Writ (1.84)	IRC (1.45) Mob (1.43)	INM (1.27)	Mob (1.32)	Writ (1.70)
WWW (1.71) INM (1.35)	TT (1.15)	WWW (1.74) WCT (1.00)	WCT (1.17)	Mob (1.22)	WCT (1.23)	INM (1.50)
WCT (1.00)	WCT (1.00)	WCT (1.00)	INM (1.00)	TT (1.16)	INM (1.14)	WCT (1.12)

^a FTF = face to face communication, TT = Tickertape, Writ = written communication, Mob = mobile phone, Tele = telephone, WWW = world wide web, INM = instant messenger, WCT = WebCT.

To gain insight into the features of different forms of communication that cause them to be more or less favoured (RQ4), comparisons were made, both of; the strengths students associated with preferred forms of communication; and the weaknesses students mentioned as being present in less favoured forms of communication (Table 2) and the frequency with which weaknesses were mentioned for less favoured forms of communication were compared (Table 3)². The perceived strengths of preferred forms of communication tended to be that they were convenient, easy to use, inexpensive and allowed instantaneous or 'real time' communication. The perceived weaknesses of less favoured devices were commonly that they were slow, difficult to use, expensive, intrusive and offered only limited channels of communication.

² Forms of communication were considered to be 'preferred' when their mean overall use score was over 2, those with mean overall use scores below 2 were considered less favoured.

The most commonly cited strength of face to face communication was that it allows multiple channels of communication. Student responses categorised as ‘allowing multiple channels of communication’ tended to refer to the value of being able to interpret non-verbal behaviour such as tone of voice, posture and facial expression. It is largely this feature of face to face communication, and the fact that it is instantaneous or ‘real time’, which makes it preferable to the various forms of computer-mediated communication available (RQ6). Moreover, face to face communication is unlikely to be expensive, slow, intrusive or difficult to use (the commonly perceived weaknesses of less favoured devices, mentioned above). One form of computer-mediated communication that satisfies the requirements of being able to carry multiple channels of communication in ‘real time’, without being slow, intrusive or difficult to use is high bandwidth video conferencing. Although video conferencing is expensive to set-up, it is not necessarily expensive to use. Video conferencing also has the advantage of allowing users to be geographically distributed when they are communicating. A large number of ‘web-cameras’ have been purchased for use within the Information Environments degree and future research will assess how students use and perceive them, and what value they have as a communication device compared to face to face communication.

STRENGTH	Face to Face	Email	MOO	Telephone
Can delay consider response		4		
Convenient	6	21	2	14
Easy	7	8	5	9
Fun/satisfying	1		21	
Inexpensive	2	3	1	10
Instantaneous / real time	7		2	5
Large network of users		2		3
Logged		4		
Multiple channels	20	3		
Users can be distributed		4	5	
Allows simultaneous communication with many			3	

Table 2. Frequency of perceived strengths of preferred means of communication.

WEAKNESS	IRC	Tickertape	WWW	Mobile	Written	INM	WebCT
Slow	8	4	6		13	1	1
Difficult to use	4	8	1		4	1	1
Limited channels of input	4	2	7		5	1	
Expensive			1	22			
Requires availability of specific device/application	5	1	2	5	3		
Requires parties to be in a specific location	3	1					
Not logged		2					
Intrusive	3	8		4		2	
Susceptible to Spam	3	4	1				

Table 3. Frequency of perceived weaknesses of less favoured forms of communication.

Perhaps unsurprisingly, the most commonly perceived strengths of Email and telephones, were their convenience and ease of use. Interestingly, however, the MOO’s major perceived strength was that it is fun and satisfying to use. It seems likely that students are gaining satisfaction from programming objects in the MOO and interacting with their peers. Thus, while the MOO is providing a means of communication for students, it is probably an environment in which they can relax and enjoy chatting and interacting socially (see Table 4).

In order to explore the purposes for which students were using particular forms of communication (RQ6), the percentage of students who indicated having used devices for particular purposes were compared (Table 4). The only devices used more for learning related activities (discussing information environments work or assessment) than other activities (paid work, social activities, and chatting/interacting socially) were email and tickertape. The majority of devices had been more often used for discussing social activities and interacting socially than they had for discussing strictly learning related matters. Whilst this could be seen as concerning from a pedagogical perspective, it is likely that being able to communicate socially through a variety of devices within the degree leads to social cohesiveness amongst the students. Such solidarity and camaraderie is likely to benefit students when it comes to working together on group projects.

Communication Topic	Mob	Tele	IRC	Moo	Email	WWW	Tt	Ftf	INM	Wri
Inf. Env. work	14.3	66.1	25.0	48.2	91.1	23.2	37.5	98.2	12.5	23.2
Assessment	25.0	73.2	21.4	55.4	91.1	25.0	35.7	100	12.5	25.0
Paid work	10.7	25.0	8.9	1.8	21.4	5.4	1.8	57.1	7.1	14.3
Social Activities	37.5	67.9	26.8	21.4	53.6	7.1	10.7	91.1	17.9	17.9
Chat/interact socially	35.7	67.9	42.9	67.9	67.9	19.6	44.6	98.2	30.4	26.8
Other	26.8	14.3	3.6	28.6	12.5	37.5	8.9	16.1	5.4	23.2

Table 4. Percentage of students who have used devices for communicating about particular topics. Web CT was excluded from this analysis on the basis that the majority of students had never used it. Mob = mobile phone, Tele = telephone, Tt= tickertape, Ftf = face to face, INM = instant messenger, Wri = written comm.

Conclusion

A number of important conclusions can be drawn from the present study, these have educational implications specific to the BInfEnv degree, but are also relevant to other learning environments utilising computer-mediated communication.

It is clear from the study that the students did not view WebCT as an appropriate forum for communication, preferring instead environments such as the MOO or IRC. This highlights the need for flexibility on the part of those implementing forms of communication (in this case, the staff). In the BInfEnv degree, students had a large degree of freedom as to which of the provided communication methods they used, to the point of being able to integrate entirely new forms of communication. This freedom has two important pedagogical implications. First, such flexibility most likely maximises the overall level of communication within the degree. If students had no alternative but to communicate via WebCT it is unlikely that they would communicate (with each other and staff) to the extent they do via alternative methods such as IRC. Second, giving BInfEnv students the freedom to select alternative methods of communication has led to a situation in which IRC has been embraced as a form of communication. This, in turn, creates alternative learning environments for staff to explore and future research will be directed at assessing the use of IRC (and the MOO) as spaces in which subject related discussions can be conducted.

The study also highlighted the advantages of following up on students' understanding of communication devices. Tickertape is not being optimally used by students, most likely

as a function of a lack of awareness of its features. Effort needs to be expended on deepening student's understanding of Tickertape and future research will be directed at assessing its use in the degree.

The results of the present study also hint at students' use of communication mediums for the purpose of 'social bonding'. Such behaviour is of benefit to the students and thus to the degree. Ways in which this can be fostered and encouraged should also be explored.

Finally, the study revealed that overall, students prefer face-to-face communication to all forms of computer-mediated communication. The reason for this seems to be that face-to-face communication allows for non-verbal, personal information to transpire in a real time, synchronous setting. As video conferencing is a form of computer-mediated communication that potentially provides such features it will be interesting to observe the introduction of web-cams to the degree in the coming year. Although, it would be disadvantageous for students to limit themselves to face-to-face communication in the BInfEnv degree, it is encouraging to know that they recognise the values of personal interaction and that they're aware that for the time being, technology is not a substitute for the rich and diverse interactions possible in-situ.

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